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# NASA TECH BRIEF



## Foaming-Electrolyte Fuel Cell

Improvement of a porous electrode in which fuel gas reacts at a static, three-phase interface between fuel gas, electrolyte, and electrode material may be accomplished by the use of a foam structure which feeds a fuel gas solution into the electrolyte. Supported by reactant gases, this foam ideally consists of masses of small bubbles with a wall thickness approaching $10^{-6}$cm, and allows rapid diffusion of the trapped gas into the surrounding electrolyte film.

Rapid gas saturation of the electrolyte is intensified by the provision of a large contact area and a short diffusion path. An alkaline electrolyte (6N KOH) is used to dissolve the fuel gas and to provide sufficiently high electrical conductivity to minimize resistive losses.

This innovation is based on the formation of foam from the fuel and some acid or alkali of the same nature and concentration as the main body of electrolyte. The foam is formed when fuel is fed through fine jets or porous material into the alkali or acid, creating bubbles not exceeding 1 mm in diameter. Foam formation and stability are enhanced by the use of a suitable foaming agent. A continuous supply of gas-saturated electrolyte to the working electrode surface is provided by the electrolyte in the foam draining back to the main body of electrolyte via the electrode. Alternatively, when formed, the foam may be passed through the cell so as to sweep over the electrode, forming an electrical contact between the main body of electrolyte and the electrode, then swept out of the cell, transporting the water and other by-products of the chemical reaction with it. Following passage through the cell, the foam is destroyed and the liquid purified for recirculation. As each bubble only contains the fuel for oxidation or reduction, the fuel-containing film soon becomes saturated with fuel, and thus is able to support a continuous reaction (oxidation or reduction) at the electrode/electrolyte interface.

This innovation is adaptable to large scale and simple fuel cell structure to include emulsions of liquid fuels such as hydrocarbons which are poorly soluble in aqueous electrolytes.

### Note:

Requests for further information may be directed to:

Technology Utilization Officer
Headquarters
National Aeronautics
and Space Administration
Washington, D.C. 20546
Reference: TSP70-10097

### Patent status:

Inquiries about obtaining rights for the commercial use of this invention may be made to NASA, Code GP, Washington, D.C. 20546.

Source: Leonard Nanis and Alan P. Saunders of
University of Pennsylvania
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Category 01